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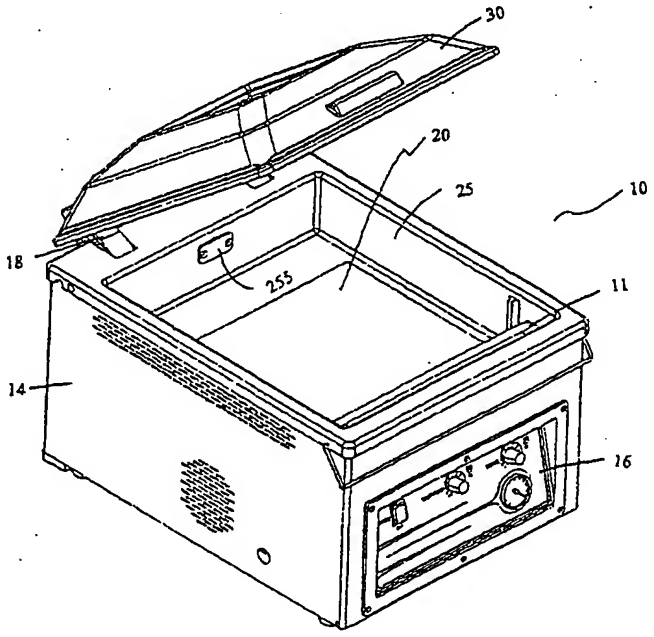
(54) Title: INJECTION-MOLDED VACUUM PACKAGING MACHINE



(57) Abstract: A vacuum packaging machine having a chamber comprised of an injection-molded lid and an injection-molded basin.

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INJECTION-MOLDED VACUUM PACKAGING MACHINE

FIELD OF THE INVENTION

This invention relates to a vacuum packaging machine having an injection-molded lid and basin comprised of an impact-modified resin.

BACKGROUND OF THE INVENTION

Vacuum packaging is the process of removing air from around a product and then sealing that product in an airtight environment. Vacuum packaging machines have a wide variety of food and non-food applications. A vacuum packaging machine may protect food from contamination from the air, the most common cause of spoilage. The machine may also be used for storing medical applications or electronic components.

Various vacuum packaging machines are well-known in the art. They vary in size from small table-top machines to large free-standing machines. For example, Applicant manufactures a series of table-top vacuum packaging machines marketed under the name ULTRAVAC®, the features of which are incorporated herein by reference. In general, the machines are comprised of a vacuum chamber made of a basin and a lid. After opening the lid, the product to be vacuum-sealed is inserted into the chamber in a plastic pouch and laid across a seal bar. Once the lid is closed, a pump creates a vacuum inside the chamber and pouch to remove all of the atmosphere inside. The product is then hermetically sealed by heat and pressure from the seal bars. Some vacuum packaging machines contain a glass window in the lid to enable the user to view the contents of the chamber.

All vacuum chambers, including those utilized in Applicant's ULTRAVAC® machines, are subject to significant stresses during use. As a result, such vacuum chambers should preferably be designed to withstand a vacuum pressure of 5 torr. Moreover, the chamber should be preferably built to withstand approximately 100,000 cycles annually.

Four designs of vacuum chambers are known in the art. Some vacuum packaging machines utilize a stainless steel chamber. The chamber is made from heavy gauge sheet material with structural members to create a chamber using break and weld construction. This process has both high material and labor costs.

Another vacuum packaging chamber is made from aluminum castings designed with appropriate structures to withstand the load. While this process has lower material and labor costs, it does require subsequent machining and has high tooling costs. In addition, aluminum castings are not inherently hygienic.

Other machines use heavy acrylic sheet material (typically 0.75 to 1.0 inch) that is pressed into a bowl shape and then machined to the final dimensions. This process requires long cycle times in the press, significant machining costs, and high material costs.

Finally, smaller chamber lids comprised of a thermoset material have been prepared using compression molding, although no chamber basins have been prepared using compression molding. The process limits the features that can be molded into a single part. After molding, the lid usually requires

subsequent machining and the parts are susceptible to creep under heat exposure. Thus, there still remains a need in the industry of a vacuum packaging chamber that is comprised of a high-strength material and that can be manufactured at low costs.

SUMMARY OF THE INVENTION

Accordingly, the present invention provides a vacuum packaging machine having an injection-molded lid and an injection-molded basin comprised of a high-strength material that can be manufactured at a low cost. During operation, the chamber can withstand vacuum pressures of 5 torr. Moreover, the invention can withstand 100,000 cycles of use annually. The machine further has negligible or no shrink rate so that the chamber does not warp. Finally, the machine is not susceptible to creep upon exposure to heat.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete appreciation of the invention and many of the advantages thereof will be readily obtained as the invention becomes better understood by reference to the detailed description when considered in connection with the accompanying drawings, wherein:

FIG. 1 is an illustration of the injection-molded vacuum packaging machine having an injection-molded lid and basin wherein the lid is in the open position.

FIG. 2 is a side view of the vacuum packaging machine of the present invention with the side of the skirt removed to show the interior components of the machine.

FIG. 3 is a perspective view of the lid and a hinge block removed from the machine.

FIG. 4 is a top view of the lid of the vacuum packaging machine.

FIG. 5 is a bottom view of the lid of the vacuum packaging machine.

FIG. 6 is a two-dimensional cross-section of the vacuum packaging machine taken through line 6^1-6^1 in FIG. 4.

FIG. 7 is a two-dimensional cross-section of the lid of the vacuum packaging machine taken through line 7^1-7^1 in FIG. 5.

FIG. 8 is an expanded perspective view of the basin, seal bar, and seal bladder of the vacuum packaging machine.

FIG. 9 is a top view of the basin of the vacuum packaging machine.

FIG. 10 is a bottom view of the basin of the vacuum packaging machine.

FIG. 11 shows a front view of the basin of the vacuum packaging machine.

FIG. 12 is a back view of the basin of the vacuum packaging machine.

FIG. 13 is a side view of the basin of the vacuum packaging machine.

FIG. 14 is a two-dimensional cross-section of the basin taken through line 14^1-14^1 in FIG. 10.

FIG. 15 is a two-dimensional cross-section of the basin taken through lines 15^1-15^1 in FIG. 9.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As best illustrated by FIG. 1, the present invention relates to a vacuum packaging machine 10, and in particular to the chamber 20 of the vacuum packaging machine 10, which is comprised of an injected molded lid 30 and basin 25. While the chamber 20 of the present invention could be designed for vacuum packaging machines of various types and sizes, the preferred embodiment of the present invention is a chamber design for a table top type vacuum packaging machine 10, as illustrated in FIG. 1.

FIG. 1 illustrates the table top vacuum packaging machine with the lid 10 in the "open position" to allow an operator to load the machine 10 with product (not shown) to be vacuum sealed. In contrast, FIG. 2 illustrates the vacuum packaging machine 10 in the closed position. As seen in FIGS. 1 and 2, the vacuum chamber 20 sits on and within a rectangular skirt 14, which houses the interior components of the vacuum packaging machine 10, such as the vacuum pump 15, the hinge block 18 and lid spring 19, which fastens the chamber lid 30 to the basin 25, and the control panel 16.

As previously discussed, the product (not shown) to be vacuum-sealed is inserted into the chamber 20 in a plastic pouch (not shown) and laid across a seal bar 11. Once the lid 30 is closed, a pump creates a vacuum inside the chamber 20 and pouch to remove nearly all of the atmosphere inside. The product is then hermetically sealed by heat and pressure from the seal bars 11. Because of the vacuum being pulled through the chamber 20, the lid 30 and basin 25 of the chamber 20 of the vacuum machine 10 must be designed to

withstand a vacuum pressure of at least 5 torr and built to withstand approximately 100,000 cycles annually.

To achieve this desired strength and endurance, both the basin 25 and lid 30 of the chamber 20 of the present invention are preferably molded from IOSPLAST® 101-LGF-40 (Dow Chemical Company) or Celstran TPU-GF30-01 (Ticona, Wynona, MN), but may be made of any typical injection molding material capable of withstanding high vacuum pressures. The injection-molding machine (not shown) used to create the lid 30 and chamber 25 preferably has a tonnage of 1000 and a barrel size of 225 oz. Processing cycle times range from about 152 to 162 seconds with a standard injection time of about 4.5 seconds, injection hold time of about 4.0 seconds, and a cooling time of about 120.0 seconds. Nozzle temperatures range in the area of about 460 °F. Injection molding pressures are in the range of 1400 to 1500 psi, with a hold pressure of 500 and a back pressure of 10 psi. The shot size is 14.91 lbs. for the basin and 9.33 lbs. for the lid. The dryer temperature is about 180 °F with an approximate drying time of 4 hours.

A. The Injection-Molded Lid

The chamber lid 30 of the present invention is best illustrated in FIGS. 1 and 3-7. The lid 30 is generally rectangular and concave in shape and, in the preferred embodiment, measures 563.0 mm by 474.0 mm and has a depth of 97.5 mm. Although the lid 30 comprises a continuous piece of material made from an injection molding process, the lid 30 has a number of functional attributes that shall be separately described. Moreover, although the

embodiment of the lid described herein relates to one for a table-top vacuum-packaging machine, one skilled in the art will recognize that various attributes may be modified, removed, or added when used in connection with different vacuum packaging machines.

As shown in FIGS. 4 and 5, the lid 30 is comprised of a top rectangular piece 35 having a rectangular hole 40 and four trapezoidal side pieces 60, 70, 80, 90 extending from the top rectangular piece 35. The non-parallel edges of two adjacent trapezoidal side pieces come together to form a rounded corner of the lid (see FIGS. 1 and 3-5). The lid thus contains four rounded corner areas 150, 160, 170, 180 defined by the edges of the trapezoidal side pieces. Overall, the lid 30 has a concave shape.

The top rectangular piece 35 has both an outer surface 37 and an inner surface 39. A rectangular L-shaped ledge 57 extends from the inner surface 39 into the hole 40. The L-shaped ledge 57 supports a rectangular piece of glass (not shown) for viewing the contents of the chamber 20. In the preferred embodiment, the rectangular hole measures 241.3 mm by 165.1 mm, and the ledge extends into the hole 12.7 mm.

In the preferred embodiment, each of the four side pieces 60, 70, 80 and 90 contains two sections: an upper section (62, 72, 82, 92) and a lower section (64, 74, 84, 94). The lower section is positioned more vertically (relative to the top rectangular piece 35) than the upper section in order to give the lid 30 a more concave shape overall (see FIGS. 1 and 3). The area where the top rectangular piece 35 meets each upper section is rounded, having a radius of

25.4 mm in the preferred embodiment. Similarly, the area where the each upper section meets each corresponding lower section is also rounded, having a radius of 22.2 mm. The upper section and lower section may have a different thickness. In the preferred embodiment, the upper section (62, 72, 82, 92) has a thickness of 7.0 mm while the lower section (64, 74, 84, 94) has a thickness of 6.4 mm.

Each of the four trapezoidal side pieces 60, 70, 80, 90 further contains two faces: an outer face (66, 76, 86, 96) and an inner face (68, 78, 88, 98). The lower section (64, 74, 84, 94) of each side piece also contains a rounded bulging edge 50 with a groove 52. A two-dimensional cross-section of the rounded bulging edge 50 and the groove 52 is depicted in FIG. 6. In the preferred embodiment, the groove 52 has a width of 8.0 mm and a depth of 5.8 mm. The exterior edges 53 and the interior edges 55 of the groove 52 are rounded, having a radius of 1.2 mm and 2.4 mm, respectively. As shown in FIG. 3, the lid gasket 17 fits into the groove 52.

Trapezoidal side piece 60 further contains an L-shaped handle 100 extending from the lower section 64. The handle 100 has a preferable thickness of 6.35 mm. A cross-section of the handle 100 is shown in FIG. 6.

Trapezoidal side piece 80 contains two hinge extensions 105 located in outer face 86 of the lower section 84. In the preferred embodiment, the lid 30 is connected to the basin 25 using the hinge assembly described in Harte, U.S. Patent No. 5,465,557, assigned to Koch Supplies Inc., which is fully incorporated here by reference. The hinge extensions 105, which contain one

or more screw holes 107, are used to connect the injection molded lid 30 to two hinge blocks 18 (see FIG. 1). A two-dimensional cross-section of one of the hinge extensions is shown in FIG. 7. Various other hinge assemblies, however, may be used to mount the lid 30 to the basin 25.

As shown in FIG. 5, the lid 30 may contain one or more reinforcement bars 120. In the preferred embodiment, four reinforcement bars span part of the ledge 57, the inner surface 39 of the top rectangular piece 35, and the inner faces 68, 78, 88, 98 of the four trapezoidal side pieces 60, 70, 80, 90. The reinforcement bars 120 are positioned to form a grid in the shape of a "tic-tac-toe" square, each bar being parallel to one other bar and perpendicular to two other bars. The bars 120 are positioned so that the "center square" formed by the bars outlines part of the L-shaped ledge 57 in the lid 30. The bars have preferred thickness of 5.1 mm and a height of 29.4 mm.

The four rounded corners 150, 160, 170, 180 each contain features designed for additional strength. First, the thickness of the lid at the corners is gradually increased. In the preferred embodiment, the thickness of the corners is increased by 3.2 mm at the corners. Second, as shown in FIG. 5, the corners 150, 160, 170, 180 may contain one or more reinforcement strips 190. The reinforcement strips 190 preferably extend from the reinforcement bars 120 to the rounded bulging edge 50 located near the hinge extensions 105. These reinforcement strips 190 thus provide the lid 30 with additional strength near the hinge extensions 105.

The inner faces 68, 78, 88, 98 of the upper sections 62, 72, 82, 92 of each trapezoidal side piece also contain an attachment boss 194. Two of the attachment bosses 194 are used to mount the back-up bar 12 to the lid 30 while the other two provide additional strength to the lid 30.

As illustrated by FIG. 3, the lid-gasket 17 and a hinge block 18 are attached to the basin and used to anchor the lid 30 to the basin 25.

B. The Injection-Molded Basin

The basin 25 of the chamber 20 is best illustrated in FIGS. 1 and 8-15. FIG. 8 shows an expanded perspective view of the injection molded basin 25 with a seal bar 11 and seal bladder 13. Although the basin 25 comprises a continuous piece of material made from an injection molding process, the basin 25 has a number of functional attributes that shall be describe separately. Although the embodiment for the basin described herein relates to one for a table-top vacuum-packaging machine, one skilled in the art will recognize that the various attributes may be modified, removed, or added when used in conjunction with a different vacuum packaging machine.

The basin 25 is comprised of a bottom wall 210 having an interior surface 215 and exterior surface 217 and four side walls 220, 230, 240, and 250, each having an interior face (222, 232, 242, 252) and an exterior face (224, 234, 244, 254). In the preferred embodiment, the bottom wall measures 495.0 mm x 422.0 mm x 6.4 mm and is slightly concave, having a depth of 3.8 mm. The side walls have a thickness of 6.5 mm.

The four side walls 220, 230, 240, 250 are connected to each other so as to form a rounded corner having a radius of 6.4 mm (see FIG. 8). Similarly, the four side walls are connected to the bottom wall 210 to form a rounded connection having a radius of 6.4 mm (see FIG. 8).

Extending from three of the side walls 220, 230, 240 is an L-shaped lip 260 shown in FIGS. 14 and 15. The lip 260 has a horizontal portion 262 measuring 40.2 mm and a vertical portion 264 measuring 25.0 mm. The vertical portion 264 has a 14.2 mm thickness. The vertical portion 264 contains a vertical slit 266. During operation, the skirt 14 fits into the slit 266 and connects the skirt 14 to the basin 25.

A flattened edge 270 extends horizontally from side wall 250. In the preferred embodiment, the flattened edge 270 has a width of 95.2 mm. Thus, in the preferred embodiment, the basin has a total length of 633.7 mm (measured as a 495.0 mm bottom piece and a 92.2 mm flattened edge). The edge 270 contains two hinge slots 275. The two hinge slots 275 receive the two hinge blocks 18 used to fasten the lid 30 to the basin 25. As shown in FIG. 10, the flattened edge 270 also contains four strength strips 218 in each corner. Each strength strip 218 contains a slot 219.

The basin 25 may contain one or more strength ribs. In the preferred embodiment, seven u-shaped strength ribs 280 span the exterior surface 217 and exterior faces 224 and 234 along the length of the basin 25. Each corner of the "U" has a radius of 24.4 mm (see FIG. 8). The thickness of the strength ribs

is 3.79 mm along the exterior surface 217 and is thinner along exterior faces 224 and 234.

Four u-shaped strength ribs 290 span the exterior surface 217 and exterior faces 244 and 254 along the width of the basin 25. Each corner of the "U" has a radius of 24.4 mm (see FIG. 8). Part of two of the four-u-shaped strength ribs 291 are positioned on exterior faces 254 adjacent to each hinge slot 275 and contain one or more pivot holes 277. Two hinge plates 279 also having pivot holes 277 extend from exterior faces 254 adjacent to each hinge slot 275. During use, the ribs 291 and the hinge plates 279 are used to fasten a hinge block 18 to the basin 25. A fifth L-shaped strength rib 293 spans the exterior surface 217 and the exterior face 244 (but not exterior 254). Strength rib 293 does not span the exterior face 254 so that a vacuum block assembly 255 (see FIG. 1) may be attached in that region of the basin 25. FIG. 12 shows a vacuum hole 256 for receiving a vacuum hose (not shown) and two vacuum block screw holes 257 used to mount the vacuum block assembly 255.

The strength ribs 290, 293 spanning the length of the basin 25 and the strength ribs 280 spanning the width of the basin 25 together form a grid along the exterior surface 217 of the bottom wall 210 of the basin 25. In the preferred embodiment, the strength ribs have a thickness ranging from 2.5 to 7.0 mm. In addition, the strength ribs are generally wider along the exterior surface 217 as compared to the exterior faces 224, 234, 244, 254. In the preferred embodiment, the strength ribs have a width of 25.5 mm along the exterior faces 224, 234, 244, 254 and a width of 41.3 mm along the exterior surface 217.

The bottom wall 210 contains several features useful in the function of the packaging machine 10. As shown in FIGS. 9, 10, and 15, near side wall 240, the bottom wall 210 has a seal bladder barb 300. In the preferred embodiment, the bladder barb 300 has an outer radius of 30.0 mm and an inner radius of 19.9 mm. Turning now to FIGS. 9 and 15, the bottom wall 210 also contains two vertical pins 305 that operate as a guide for the seal bar 11. In the preferred embodiment, the vertical pins 305 have a height of 20.8 mm and a radius of 12.6 mm. FIGS. 9 and 15 further show that extending from the bottom wall 210 along the interior faces 222, 232 of side walls 220, 230 are two vertical bars 310 that operate as a guide for the filler plates in the machine. FIG. 10 illustrates that the basin 25 contains two spring bosses 315. A spring extends between each hinge block 18 and the spring bosses 315 as shown in FIG. 2. Six holes 320 are located along strength bars 280 to permit attachment of wires and vacuum hoses (not shown) needed to operate the machine. Two apertures 325 are located in the bottom wall 210 to permit attachment of wires for the seal bar. Finally, strength bars 280, 290, and 293 contain a number of cylindrical ejector pin bosses (not depicted in the drawings). In the preferred embodiment, there are approximately 26 ejector pin bosses located on strength bars 280 and 290 along the exterior surface 217 of the basin.

Although the foregoing detailed description of the present invention has been described by reference to a single exemplary embodiment, and the best mode contemplated for carrying out the present invention has been herein shown and described, it will be understood that modifications or variations in

the structure and arrangement of this embodiment other than those specifically set forth herein may be achieved by those skilled in the art and that such modifications are to be considered as being within the overall scope of the present invention. Therefore, it is contemplated to cover the present invention and any and all modifications, variations, or equivalents that fall within the true spirit and scope of the underlying principles disclosed and claimed herein. Consequently, the scope of the present invention is intended to be limited only by the attached claims.

We claim:

1. A vacuum packaging machine having a vacuum pump and a vacuum chamber, wherein said chamber is comprised of a lid and a basin, said lid being injection-molded.

2. The machine as recited in claim 1 wherein said lid is comprised of a glass-filled resin.

3. The machine as recited in claim 1 wherein said lid is comprised of ISOPLAST 101 or Celstran TPU-GF30-01.

4. The machine as recited in claim 1 wherein said lid is concave.

5. The machine as recited in claim 1 wherein said lid contains a hole for viewing the contents of said machine during operation.

6. The machine as recited in claim 5 further comprising an L-shaped ledge that extends into said hole.

7. The machine as recited in claim 1 wherein said lid has four trapezoidal side pieces.

8. The machine as recited in claim 7 wherein said trapezoidal side pieces contain both an upper section and a lower section, said upper section being positioned more vertically than said lower section.

9. The machine as recited in claim 1 wherein said lid contains an edge having a groove.

10. The machine as recited in claim 1 wherein said lid contains at least one hinge extension.

11. The machine as recited in claim 1 wherein said lid contains at least one reinforcement bar.

12. The machine as recited in claim 11 where in said lid has two parallel and two perpendicular reinforcement bars.

13. The machine as recited in claim 1 wherein said lid contains at least one thickened corner having a reinforcement strip.

14. A vacuum packaging machine having a vacuum pump and a vacuum chamber, wherein said chamber is comprised of a lid and a basin, said basin being injection-molded.

15. The machine as recited in claim 14 wherein said basin is comprised of a glass-filled resin.

16. The machine as recited in claim 14 wherein said basin is comprised of ISOPLAST 101 or Celstran TPU-GF30-01.

17. The machine in claim 14 wherein said basin has an L-shaped lip.

18. The machine in claim 17 wherein said L-shaped lip contains a strength strip in at least one corner of said L-shaped lip.

19. The machine in claim 14 wherein said basin has at least a flattened edge containing at least one hinge slot.

20. The machine in claim 14 wherein said basin contains at least one strength rib.

21. The machine in claim 20 wherein said at least one strength rib contains at least one pivot hole, said pivot hole used to mount a hinge block assembly to said lid.

22. The machine in claim 20 wherein said basin has a bottom wall having both an interior surface and an exterior surface and at least one strength rib contains at least one hole useful for permitting wires to cross the exterior and interior surface.

23. The machine in claim 16 wherein said basin contains two vertical pins, said pins useful for guiding a seal bar during operation.

24. The machine in claim 16 wherein said basin contains two vertical bars, said bars useful for guiding at least one filler plate during operation.

25. A vacuum packaging machine having a vacuum chamber, wherein said chamber is comprised of an injection-molded lid and an injection-molded basin.

26. The machine as recited in claim 25 wherein said injection molding uses a glass-filled resin.

27. The machine as recited in claim 25 wherein said injection molding uses ISOPLAST 101 or Celstran TPU-GF30-01.

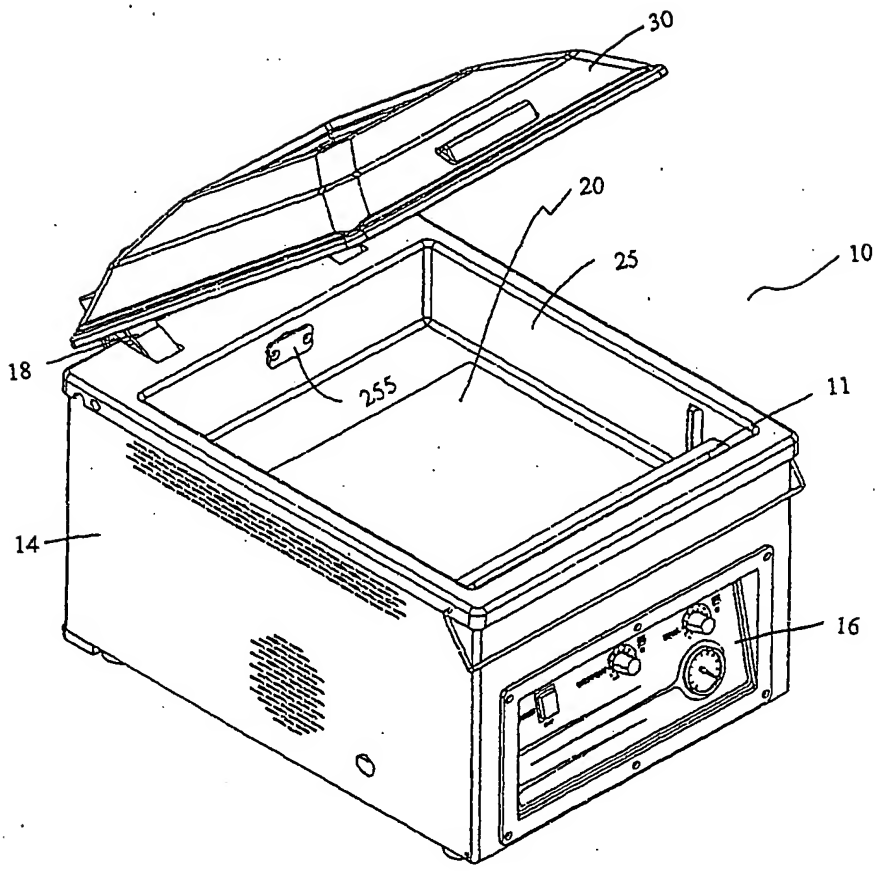

FIG. 1

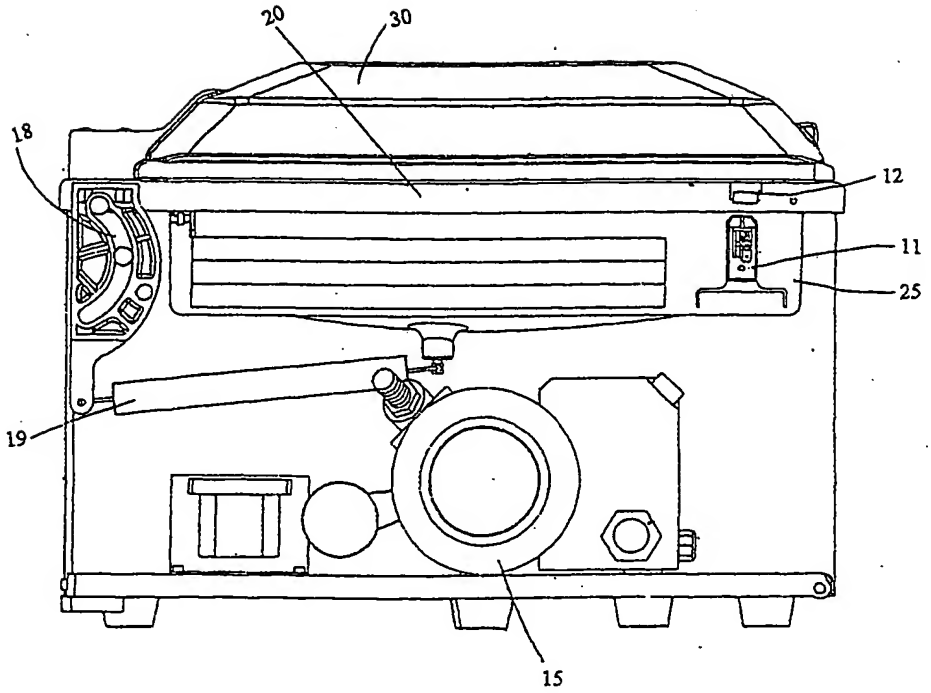

FIG. 2

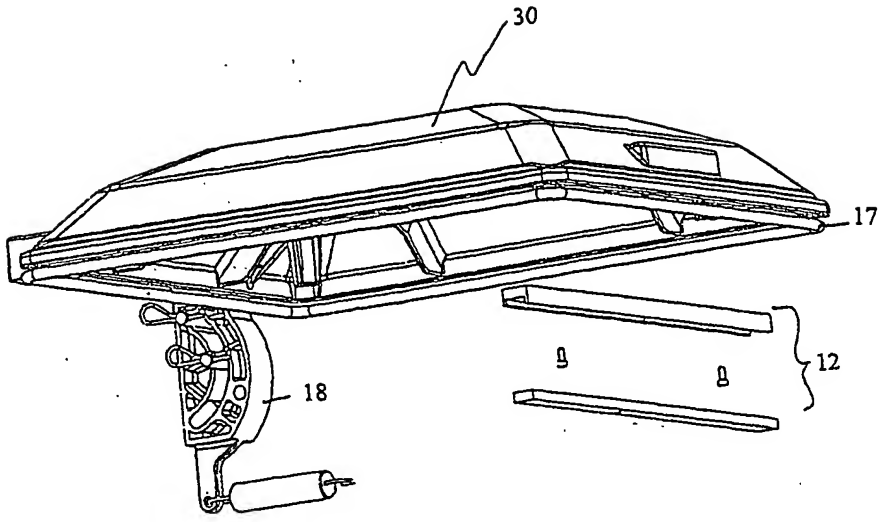

FIG. 3

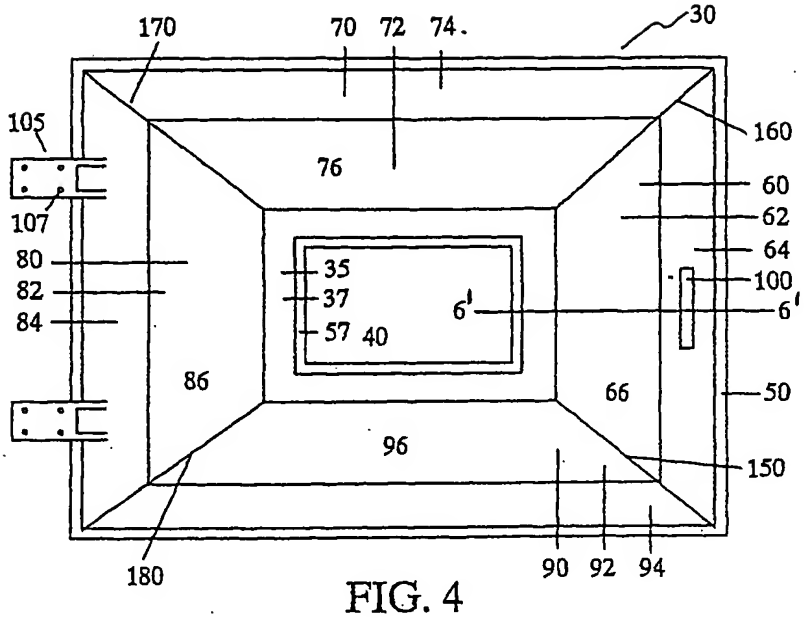
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FIG. 4

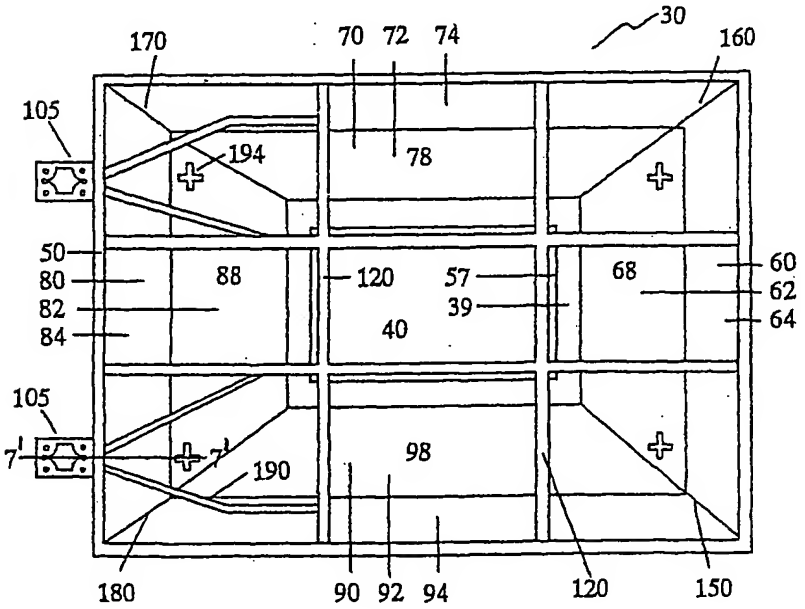
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FIG. 5

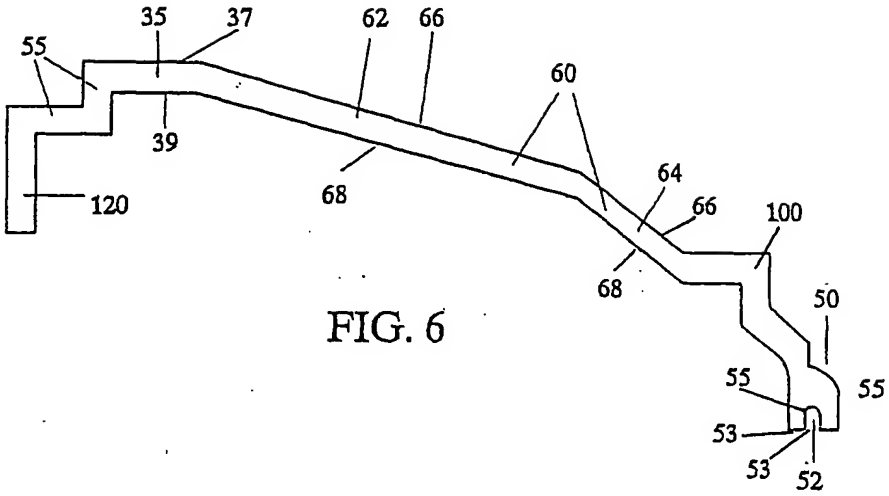
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FIG. 6

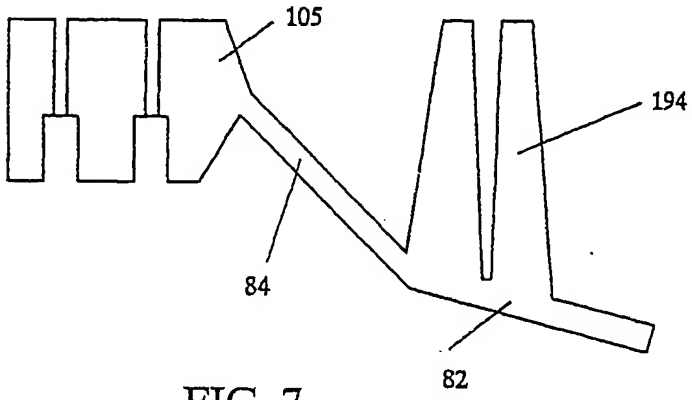
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FIG. 7

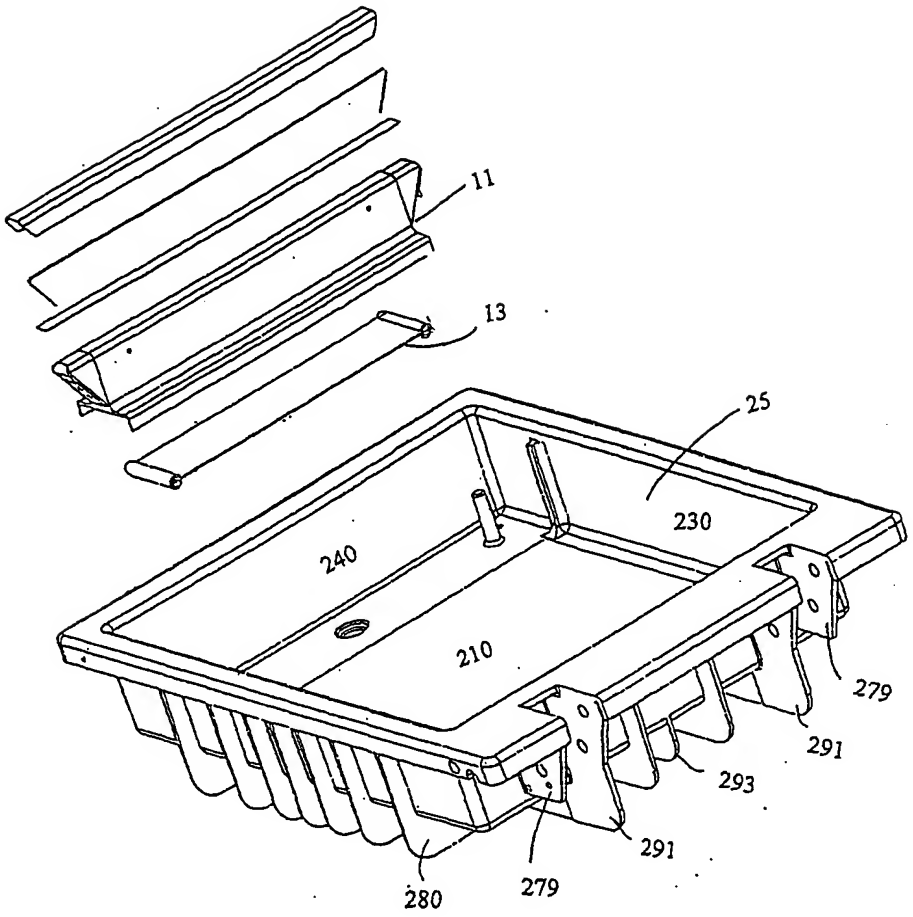
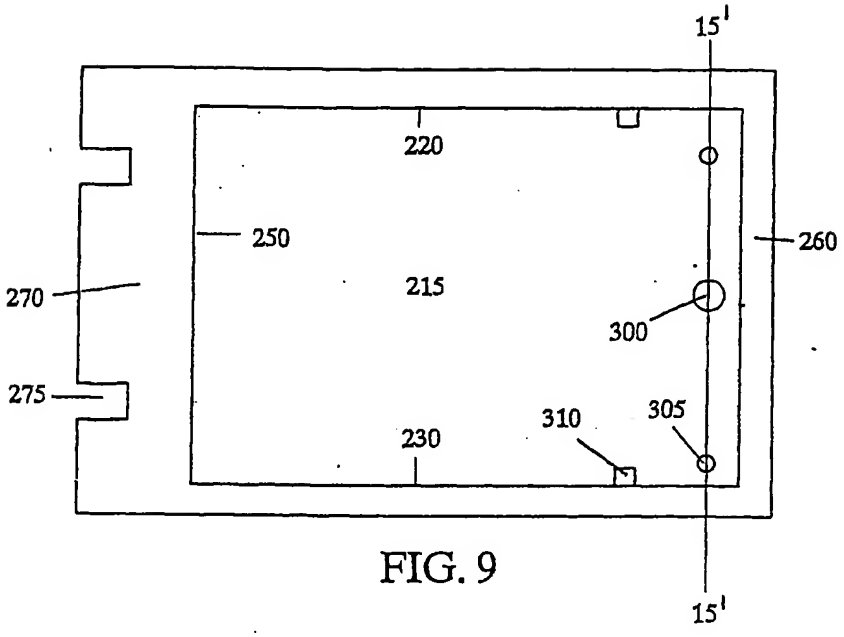


FIG. 8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15'

FIG. 9

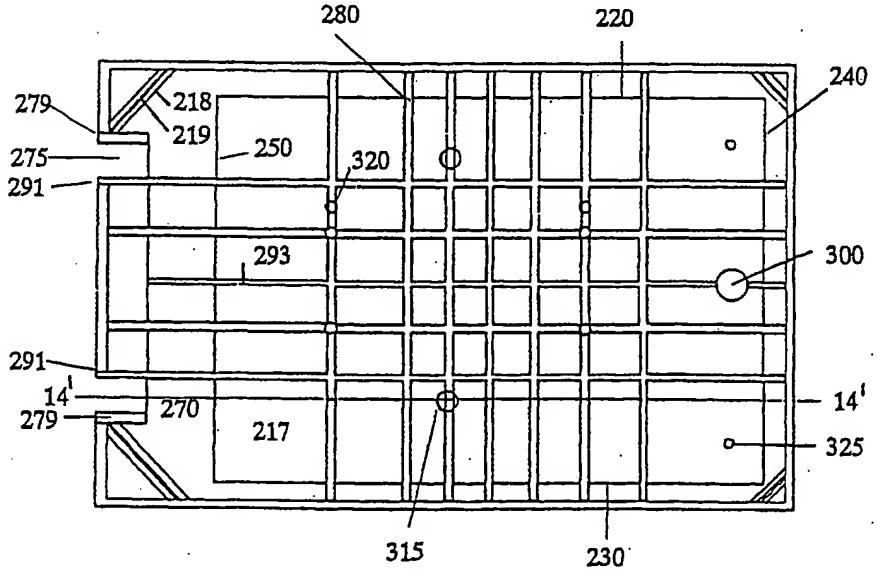
280
220
240
279
218
219
250
320
275
291
293
300
291
14'
270
279
217
14'
325
315
230

FIG. 10

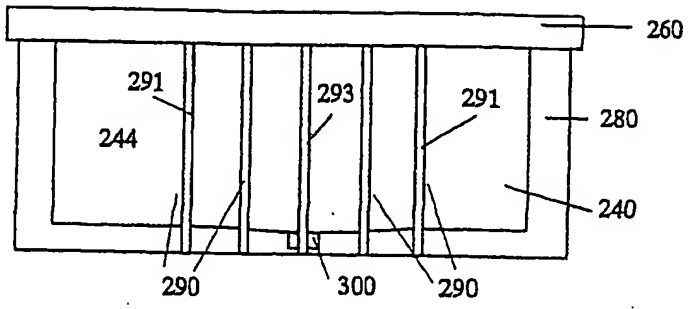

FIG. 11

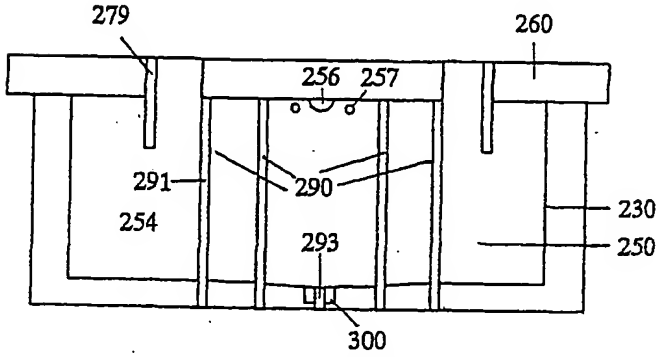

FIG. 12

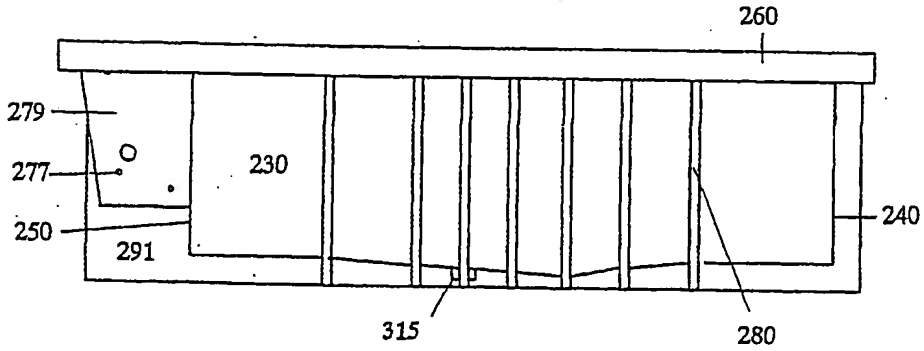

FIG. 13

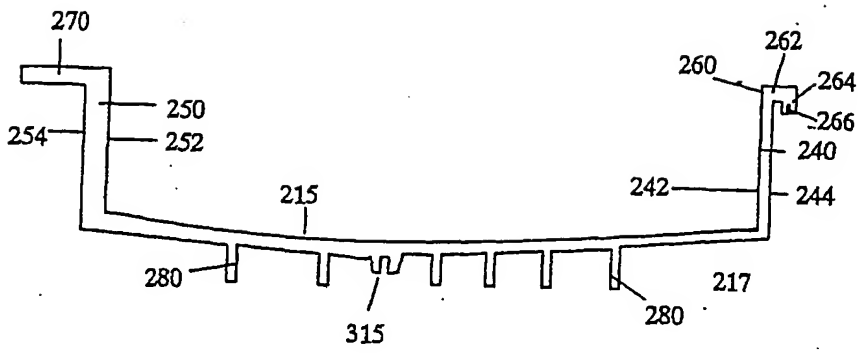
270
250
254
252
215
280
315
280
217
242
244
240
260
262
264
266

FIG. 14

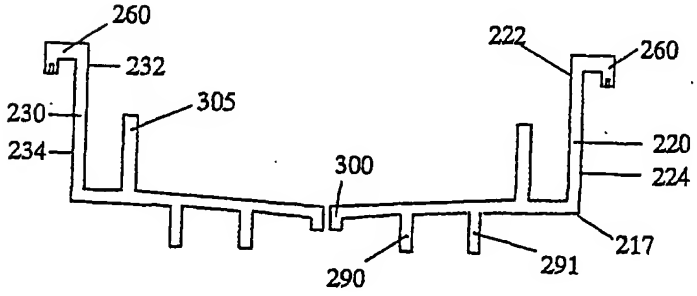
260
232
230
234
305
300
290
291
217
222
260
220
224

FIG. 15

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 01/24497

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B65B31/02 B65D81/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B65B B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 239 808 A (LEVSEN CLARK A ET AL) 31 August 1993 (1993-08-31) column 2, line 63 -column 6, line 23; figures	1,4,14, 25
A	US 4 294 056 A (PAULSEN RALF ET AL) 13 October 1981 (1981-10-13) column 3, line 14 -column 4, line 51; figures	1,14,25
A	GB 2 295 985 A (SILKJET LTD) 19 June 1996 (1996-06-19) page 5, line 1 -page 7, line 1; figures	1,14,25

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
6 December 2001	17/12/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Jagusiak, A

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INTERNATIONAL SEARCH REPORT

ormation on patent family members

International Application No
PCT/US 01/24497

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 5239808	A	31-08-1993	NONE		
US 4294056	A	13-10-1981	DE	2843166 A1	24-04-1980
			DE	2932098 A1	26-03-1981
GB 2295985	A	19-06-1996	NONE		